

SEQUENCE LISTING

<110> Lorz, et al.

<120> NUCLEIC ACID MOLECULES WHICH CODE FOR ENZYMES DERIVED FROM WHEAT AND WHICH ARE INVOLVED IN THE SYNTHESIS OF STARCH

<130> 514413-3849

<140> 09/674,817
<141> 2000-11-06

<150> PCT/EP99/03141
<151> 1999-05-07

<150> 19820608.9
<151> 1998-05-08

<160> 10

<170> PatentIn version 3.0

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Ala Gly Lys Gly Val Gly Glu Val Cys Ala Ala Val Val Glu Ala Ala			
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ac ^g aag gta gag gac gag ggg gag gac gag cc ^g gt ^g g ^c g gag gac			143
Thr Lys Val Glu Asp Gly Glu Asp Gly Asp Glu Pro Val Ala Glu Asp			
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agg tac g ^c g ctc ggc ggc g ^c g tgc agg gt ^g ctc gcc gga at ^g ccc g ^c g			191
Arg Tyr Ala Leu Gly Gly Ala Cys Arg Val Leu Ala Gly Met Pro Ala			
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cc ^g ctg ggc gcc acc g ^c g ctc gcc ggc ggg gtc aat ttc gcc gtc tat			239
Pro Leu Gly Ala Thr Ala Leu Ala Gly Gly Val Asn Phe Ala Val Tyr			
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tcc ggc gga gcc acc g ^c g g ^c g ctc tgc ctc ttc ac ^g cca gaa gat			287
Ser Gly Gly Ala Thr Ala Ala Leu Cys Leu Phe Thr Pro Glu Asp			
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ctc aag g ^c g gtggggttgc ctcccagta gagttcatca gctttgcgtg			336
Leu Lys Ala			
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gat agg gt ^g acc gag gag gtt ccc ctt gac ccc ctg at ^g aat cg ^g acc			444
Asp Arg Val Thr Glu Glu Val Pro Leu Asp Pro Leu Met Asn Arg Thr			
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Gly Asn Val Trp His Val Phe Ile Glu Gly Glu Leu His Asn Met Leu			
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Tyr Gly Tyr Arg Phe Asp Gly Thr Phe Ala Pro His Cys Gly His Tyr			
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Leu Asp Val Ser Asn Val Val Asp Pro Tyr Ala Lys Ala Val Ile			
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Ser Arg Gly Glu Tyr Gly Val Pro Ala Arg Gly Asn Asn Cys Trp Pro			
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Gln Met Ala Gly Met Ile Pro Leu Pro Tyr Ser Thr Phe Asp Trp Glu			
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Gly Asp Leu Pro Leu Arg Tyr Pro Gln Lys Asp Leu Val Ile Tyr Glu			

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ctt gga gtt aat tgt att gaa tta atg ccc tgc cat gag ttc aac gag Leu Gly Val Asn Cys Ile Glu Leu Met Pro Cys His Glu Phe Asn Glu 245	250	255		876
ctg gag tac tca acc tct tcc aag atg aac ttt tgg gga tat tct Leu Glu Tyr Ser Thr Ser Ser Lys Met Asn Phe Trp Gly Tyr Ser 260	265	270		924
acc ata aac ttc ttt tca cca atg aca aga tac aca tca ggc ggg ata Thr Ile Asn Phe Phe Ser Pro Met Thr Arg Tyr Thr Ser Gly Gly Ile 275	280	285	290	972
aaa aac tgt ggg cgt gat gcc ata aat gag ttc aaa act ttt gta aga Lys Asn Cys Gly Arg Asp Ala Ile Asn Glu Phe Lys Thr Phe Val Arg 295	300	305		1020
gag gct cac aaa cgg gga att gag gtg atc ctg gat gtt gtc ttc aac Glu Ala His Lys Arg Gly Ile Glu Val Ile Leu Asp Val Val Phe Asn 310	315	320		1068
cat aca gct gag ggt aat gag aat ggt cca ata tta tca ttt aag ggg His Thr Ala Glu Gly Asn Glu Asn Gly Pro Ile Leu Ser Phe Lys Gly 325	330	335		1116
gtc gat aat act aca tac tat atg ctt gca ccc aag gga gag ttt tat Val Asp Asn Thr Thr Tyr Tyr Met Leu Ala Pro Lys Gly Glu Phe Tyr 340	345	350		1164
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cgt caa ttc att gta gat tgt tta aga tac tgg gtg acg gaa atg cat Arg Gln Phe Ile Val Asp Cys Leu Arg Tyr Trp Val Thr Glu Met His 375	380	385		1260
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agt ctg tgg gat cca gtt aac gtg tat gga gct cca ata gaa ggt gac Ser Leu Trp Asp Pro Val Asn Val Tyr Gly Ala Pro Ile Glu Gly Asp 405	410	415		1356
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35 40 45

Tyr Ala Leu Gly Gly Ala Cys Arg Val Leu Ala Gly Met Pro Ala Pro
50 55 60

Leu Gly Ala Thr Ala Leu Ala Gly Gly Val Asn Phe Ala Val Tyr Ser
65 70 75 80

Gly Gly Ala Thr Ala Ala Leu Cys Leu Phe Thr Pro Glu Asp Leu
85 90 95

Lys Ala Asp Arg Val Thr Glu Glu Val Pro Leu Asp Pro Leu Met Asn
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Arg Thr Gly Asn Val Trp His Val Phe Ile Glu Gly Glu Leu His Asn
115 120 125

Met Leu Tyr Gly Tyr Arg Phe Asp Gly Thr Phe Ala Pro His Cys Gly
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His Tyr Leu Asp Val Ser Asn Val Val Val Asp Pro Tyr Ala Lys Ala
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Val Ile Ser Arg Gly Glu Tyr Gly Val Pro Ala Arg Gly Asn Asn Cys
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Trp Pro Gln Met Ala Gly Met Ile Pro Leu Pro Tyr Ser Thr Phe Asp
180 185 190

Trp Glu Gly Asp Leu Pro Leu Arg Tyr Pro Gln Lys Asp Leu Val Ile
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Tyr Glu Met His Leu Arg Gly Phe Thr Lys His Asp Ser Ser Asn Val
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Glu His Pro Gly Thr Phe Ile Gly Ala Val Ser Lys Leu Asp Tyr Leu
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Lys Glu Leu Gly Val Asn Cys Ile Glu Leu Met Pro Cys His Glu Phe
245 250 255

Asn Glu Leu Glu Tyr Ser Thr Ser Ser Lys Met Asn Phe Trp Gly
260 265 270

Tyr Ser Thr Ile Asn Phe Phe Ser Pro Met Thr Arg Tyr Thr Ser Gly
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Gly Ile Lys Asn Cys Gly Arg Asp Ala Ile Asn Glu Phe Lys Thr Phe
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Val Arg Glu Ala His Lys Arg Gly Ile Glu Val Ile Leu Asp Val Val
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Phe Asn His Thr Ala Glu Gly Asn Glu Asn Gly Pro Ile Leu Ser Phe
325 330 335

Lys Gly Val Asp Asn Thr Thr Tyr Tyr Met Leu Ala Pro Lys Gly Glu
340 345 350

Phe Tyr Asn Tyr Ser Gly Cys Gly Asn Thr Phe Asn Cys Asn His Pro
355 360 365

Val Val Arg Gln Phe Ile Val Asp Cys Leu Arg Tyr Trp Val Thr Glu
370 375 380

Met His Val Asp Gly Phe Arg Phe Asp Leu Ala Ser Ile Met Thr Arg
385 390 395 400

Gly Ser Ser Leu Trp Asp Pro Val Asn Val Tyr Gly Ala Pro Ile Glu
405 410 415

Gly Asp Met Ile Thr Thr Gly Thr Pro Leu Val Thr Pro Pro Leu Ile
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Glu Ala Trp Asp Ala Gly Gly Leu Tyr Gln Val Gly Gln Phe Pro His

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Gln Phe Ile Lys Gly Thr Asp Gly Phe Ala Gly Gly Phe Ala Glu Cys
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His Ser Ile Asn Phe Val Cys Ala His Asp Gly Phe Thr Leu Ala Asp
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Leu Val Thr Tyr Asn Lys Lys Tyr Asn Leu Pro Asn Gly Glu Asn Asn
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Arg Asp Gly Glu Asn His Asn Leu Ser Trp Asn Cys Gly Glu Glu Gly
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Asn Phe Phe Val Cys Leu Met Val Ser Gln Gly Val Pro Met Phe Tyr
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Met Gly Asp Glu Tyr Gly His Thr Lys Gly Gly Asn Asn Asn Thr Tyr
595 600 605

Cys His Asp Ser Tyr Val Asn Tyr Phe Arg Trp Asp Lys Lys Glu Gln
610 615 620

Tyr Ser Glu Leu His Arg Phe Cys Cys Leu Met Thr Lys Phe Arg Lys
625 630 635 640

Glu Cys Glu Gly Leu Gly Leu Glu Asp Phe Pro Thr Ala Lys Arg Leu
645 650 655

Gln Trp His Gly His Gln Pro Gly Lys Pro Asp Trp Ser Glu Asn Ser
660 665 670

Arg Phe Val Ala Phe Ser Met Lys Asp Glu Arg Gln Gly Glu Ile Tyr
675 680 685

Val Ala Phe Asn Thr Ser His Leu Pro Ala Val Val Glu Leu Pro Glu
690 695 700

Arg Ala Gly Arg Arg Trp Glu Pro Val Val Asp Thr Gly Lys Pro Ala
705 710 715 720

Pro Tyr Asp Phe Leu Thr Asp Asp Leu Pro Asp Arg Ala Leu Thr Ile
725 730 735

His Gln Phe Ser His Phe Leu Tyr Ser Asn Leu Tyr Pro Met Leu Ser
740 745 750

Tyr Ser Ser Val Ile Leu Val Leu Arg Pro Asp Val
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Thr Ala Gly Lys Gly Val Gly Val Cys Ala Ala Val Val Glu Val
15 20 25

gcg acg aag gcc gag gat gag ggg gag gag gac gag ccg gtg gcg gag 147
Ala Thr Lys Ala Glu Asp Glu Gly Glu Asp Glu Pro Val Ala Glu
30 35 40

gac agg tac gcg ctc ggc ggc gcg tgc agg gtg ctc gcc gga atg ccc 195
Asp Arg Tyr Ala Leu Gly Ala Cys Arg Val Leu Ala Gly Met Pro
45 50 55 60

acg ccg ctg ggc gcc acc gcg ctc gcc ggc ggg gtc aat ttc gcc gtc 243
Thr Pro Leu Gly Ala Thr Ala Leu Ala Gly Val Asn Phe Ala Val
65 70 75

tac tcc ggc gga gcc aca gcc gcg ctc tgc ctc ttc acg cca gaa 291
Tyr Ser Gly Gly Ala Thr Ala Ala Leu Cys Leu Phe Thr Pro Glu
80 85 90

gat ctc aag gcg gat agg gtg acg gag gag gtt ccc ctt gac ccc ctg 339

Asp	Leu	Lys	Ala	Asp	Arg	Val	Thr	Glu	Glu	Val	Pro	Leu	Asp	Pro	Leu	
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atg	aat	cgg	act	ggg	aac	gta	tgg	cat	gtc	ttc	atc	gaa	ggc	gag	ctg	387
Met	Asn	Arg	Thr	Gly	Asn	Val	Trp	His	Val	Phe	Ile	Glu	Gly	Glu	Leu	
110								115					120			
cag	gac	atg	ctt	tac	ggg	tac	agg	ttc	gac	ggc	acc	ttt	gct	cct	cac	435
Gln	Asp	Met	Leu	Tyr	Gly	Tyr	Arg	Phe	Asp	Gly	Thr	Phe	Ala	Pro	His	
125								130				135			140	
tgc	ggg	cac	tac	ctt	gat	gtt	tcc	aat	gtc	gtg	gtg	gat	cct	tat	gct	483
Cys	Gly	His	Tyr	Leu	Asp	Val	Ser	Asn	Val	Val	Val	Asp	Pro	Tyr	Ala	
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Lys	Ala	Val	Ile	Ser	Arg	Gly	Glu	Tyr	Gly	Val	Pro	Ala	Arg	Gly	Asn	
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aat	tgc	tgg	cct	cag	atg	gct	ggc	atg	atc	cct	ctt	cca	tat	agc	acg	579
Asn	Cys	Trp	Pro	Gln	Met	Ala	Gly	Met	Ile	Pro	Leu	Pro	Tyr	Ser	Thr	
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Phe	Asp	Trp	Glu	Gly	Asp	Leu	Pro	Leu	Arg	Tyr	Pro	Gln	Lys	Asp	Leu	
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Val	Ile	Tyr	Glu	Met	His	Leu	Arg	Gly	Phe	Thr	Lys	His	Asp	Ser	Ser	
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Asn	Val	Glu	His	Pro	Gly	Thr	Phe	Ile	Gly	Ala	Val	Ser	Lys	Leu	Asp	
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Glu	Phe	Asn	Glu	Leu	Glu	Tyr	Ser	Thr	Ser	Ser	Ser	Lys	Met	Asn	Phe	
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Trp	Gly	Tyr	Ser	Thr	Ile	Asn	Phe	Phe	Ser	Pro	Met	Thr	Arg	Tyr	Thr	
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Thr	Phe	Val	Arg	Glu	Ala	His	Lys	Arg	Gly	Ile	Glu	Val	Ile	Leu	Asp	
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acc aga ggt tcc agt ctg tgg gat cca gtt aac gtg tat gga gct cca Thr Arg Gly Ser Ser Leu Trp Asp Pro Val Asn Val Tyr Gly Ala Pro 400	405	410	1251
ata gaa ggt gac atg atc aca aca ggg aca cct ctt gtt act cca cca Ile Glu Gly Asp Met Ile Thr Thr Gly Thr Pro Leu Val Thr Pro Pro 415	420	425	1299
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gtt gct gaa gca tgg gat gca gga ggc ctc tatcaa gta ggt caa ttc Val Ala Glu Ala Trp Asp Ala Gly Gly Leu Tyr Gln Val Gly Gln Phe 445	450	455	1395
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gtg cgt caa ttc att aaa ggc act gat gga ttt gct ggt ggt ttt gcc Val Arg Gln Phe Ile Lys Gly Thr Asp Gly Phe Ala Gly Gly Phe Ala 480	485	490	1491
gaa tgt ctt tgt gga agt cca cac cta tac cag gca gga gga agg aaa Glu Cys Leu Cys Gly Ser Pro His Leu Tyr Gln Ala Gly Gly Arg Lys 495	500	505	1539
cct tgg cac agt atc aac ttt gta tgt gca cac gat gga ttt aca ctg Pro Trp His Ser Ile Asn Phe Val Cys Ala His Asp Gly Phe Thr Leu 510	515	520	1587
gct gat ttg gta aca tat aat aac aag tac aat tta cca aat ggg gag Ala Asp Leu Val Thr Tyr Asn Asn Lys Tyr Asn Leu Pro Asn Gly Glu 525	530	535	1635
aac aac aga gat gga gaa aat cac aat ctt agc tgg aat tgt ggg gag Asn Asn Arg Asp Gly Glu Asn His Asn Leu Ser Trp Asn Cys Gly Glu 545	550	555	1683

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aca tac tgc cat gat tct tat gtc aat tat ttt cgc tgg gat aaa aaa Thr Tyr Cys His Asp Ser Tyr Val Asn Tyr Phe Arg Trp Asp Lys Lys 605 610 615 620	1875
gaa caa tac tct gac ttg cac cga ttc tgt tgc ctc atg acc aaa ttc Glu Gln Tyr Ser Asp Leu His Arg Phe Cys Cys Leu Met Thr Lys Phe 625 630 635	1923
cgc aag gag tgc gag ggt ctt ggc ctt gag gat ttt cca acg gcc gaa Arg Lys Glu Cys Glu Gly Leu Glu Asp Phe Pro Thr Ala Glu 640 645 650	1971
cg ^g ctg cag tgg cat ggt cat cag cct ggg aag cct gat tgg tct gag Arg Leu Gln Trp His Gly His Gln Pro Gly Lys Pro Asp Trp Ser Glu 655 660 665	2019
aat agc cga ttc gtt gcc ttt tcc atg aaa gat gaa aga cag ggc gag Asn Ser Arg Phe Val Ala Phe Ser Met Lys Asp Glu Arg Gln Gly Glu 670 675 680	2067
atc tat gtg gcc ttc aac acc agc cac tta ccg gcc gtt gtt gag ctc Ile Tyr Val Ala Phe Asn Thr Ser His Leu Pro Ala Val Val Glu Leu 685 690 695 700	2115
ccg gag cgc aca ggg cgc cgg tgg gaa ccg gtg gtg gac aca ggc aag Pro Glu Arg Thr Gly Arg Arg Trp Glu Pro Val Val Asp Thr Gly Lys 705 710 715	2163
cca gca cca tac gac ttc ctc act gac gac tta cct gat cgc gct ctc Pro Ala Pro Tyr Asp Phe Leu Thr Asp Asp Leu Pro Asp Arg Ala Leu 720 725 730	2211
acc ata cac cag ttc tct cat ttc ctc aac tcc aac ctc tac ccc atg Thr Ile His Gln Phe Ser His Phe Leu Asn Ser Asn Leu Tyr Pro Met 735 740 745	2259
ctc agc tac tca tcg gtc atc cta gta ttg cgc cct gat gtt tga Leu Ser Tyr Ser Ser Val Ile Leu Val Leu Arg Pro Asp Val 750 755 760	2304
gaggcggata tacagtaaat aatatgtata tatgtagtcc ttggcgat tatcagtgtg cacaattgct ctattgccaa tgatctattc gatccacaga tacatgtgca aaaaaaaaaa	2364 2424

aaaaaaaactc gag

2437

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<211> 762
<212> PRT
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<400> 4

Pro Ala Pro Arg Leu Arg Arg Trp Arg Pro Asn Ala Thr Ala Gly Lys
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Gly Val Gly Glu Val Cys Ala Ala Val Val Glu Val Ala Thr Lys Ala
20 25 30

Glu Asp Glu Gly Glu Asp Glu Pro Val Ala Glu Asp Arg Tyr Ala
35 40 45

Leu Gly Gly Ala Cys Arg Val Leu Ala Gly Met Pro Thr Pro Leu Gly
50 55 60

Ala Thr Ala Leu Ala Gly Val Asn Phe Ala Val Tyr Ser Gly Gly
65 70 75 80

Ala Thr Ala Ala Leu Cys Leu Phe Thr Pro Glu Asp Leu Lys Ala
85 90 95

Asp Arg Val Thr Glu Glu Val Pro Leu Asp Pro Leu Met Asn Arg Thr
100 105 110

Gly Asn Val Trp His Val Phe Ile Glu Gly Glu Leu Gln Asp Met Leu
115 120 125

Tyr Gly Tyr Arg Phe Asp Gly Thr Phe Ala Pro His Cys Gly His Tyr
130 135 140

Leu Asp Val Ser Asn Val Val Val Asp Pro Tyr Ala Lys Ala Val Ile
145 150 155 160

Ser Arg Gly Glu Tyr Gly Val Pro Ala Arg Gly Asn Asn Cys Trp Pro
165 170 175

Gln Met Ala Gly Met Ile Pro Leu Pro Tyr Ser Thr Phe Asp Trp Glu
180 185 190

Gly Asp Leu Pro Leu Arg Tyr Pro Gln Lys Asp Leu Val Ile Tyr Glu
195 200 205

Met His Leu Arg Gly Phe Thr Lys His Asp Ser Ser Asn Val Glu His
210 215 220

Pro Gly Thr Phe Ile Gly Ala Val Ser Lys Leu Asp Tyr Leu Lys Glu
225 230 235 240

Leu Gly Val Asn Cys Ile Glu Leu Met Pro Cys His Glu Phe Asn Glu
245 250 255

Leu Glu Tyr Ser Thr Ser Ser Lys Met Asn Phe Trp Gly Tyr Ser
260 265 270

Thr Ile Asn Phe Phe Ser Pro Met Thr Arg Tyr Thr Ser Gly Gly Ile
275 280 285

Lys Asn Cys Gly Arg Asp Ala Ile Asn Glu Phe Lys Thr Phe Val Arg
290 295 300

Glu Ala His Lys Arg Gly Ile Glu Val Ile Leu Asp Val Val Phe Asn
305 310 315 320

His Thr Ala Glu Gly Asn Glu Asn Gly Pro Ile Leu Ser Phe Arg Gly
325 330 335

Val Asp Asn Thr Thr Tyr Tyr Met Leu Ala Pro Lys Gly Glu Phe Tyr
340 345 350

Asn Tyr Ser Gly Cys Gly Asn Thr Phe Asn Cys Asn His Pro Val Val
355 360 365

Arg Gln Phe Ile Val Asp Cys Leu Arg Tyr Trp Val Thr Glu Met His
370 375 380

Val Asp Gly Phe Arg Phe Asp Leu Ala Ser Ile Met Thr Arg Gly Ser
385 390 395 400

Ser Leu Trp Asp Pro Val Asn Val Tyr Gly Ala Pro Ile Glu Gly Asp
405 410 415

Met Ile Thr Thr Gly Thr Pro Leu Val Thr Pro Pro Leu Ile Asp Met
420 425 430

Ile Ser Asn Asp Pro Ile Leu Gly Gly Val Lys Leu Val Ala Glu Ala
435 440 445

Trp Asp Ala Gly Gly Leu Tyr Gln Val Gly Gln Phe Pro His Trp Asn
450 455 460

Val Trp Ser Glu Trp Asn Gly Lys Tyr Arg Asp Ile Val Arg Gln Phe
465 470 475 480

Ile Lys Gly Thr Asp Gly Phe Ala Gly Gly Phe Ala Glu Cys Leu Cys
485 490 495

Gly Ser Pro His Leu Tyr Gln Ala Gly Gly Arg Lys Pro Trp His Ser
500 505 510

Ile Asn Phe Val Cys Ala His Asp Gly Phe Thr Leu Ala Asp Leu Val
515 520 525

Thr Tyr Asn Asn Lys Tyr Asn Leu Pro Asn Gly Glu Asn Asn Arg Asp
530 535 540

Gly Glu Asn His Asn Leu Ser Trp Asn Cys Gly Glu Glu Gly Glu Phe
545 550 555 560

Ala Arg Leu Ser Val Lys Arg Leu Arg Lys Arg Gln Met Arg Asn Phe
565 570 575

Phe Val Cys Leu Met Val Ser Gln Gly Val Pro Met Phe Tyr Met Gly
580 585 590

Asp Glu Tyr Gly His Thr Lys Gly Gly Asn Asn Asn Thr Tyr Cys His
595 600 605

Asp Ser Tyr Val Asn Tyr Phe Arg Trp Asp Lys Lys Glu Gln Tyr Ser
610 615 620

Asp Leu His Arg Phe Cys Cys Leu Met Thr Lys Phe Arg Lys Glu Cys
625 630 635 640

Glu Gly Leu Gly Leu Glu Asp Phe Pro Thr Ala Glu Arg Leu Gln Trp

645 650 655

His Gly His Gln Pro Gly Lys Pro Asp Trp Ser Glu Asn Ser Arg Phe
660 665 670

Val Ala Phe Ser Met Lys Asp Glu Arg Gln Gly Glu Ile Tyr Val Ala
675 680 685

Phe Asn Thr Ser His Leu Pro Ala Val Val Glu Leu Pro Glu Arg Thr
690 695 700

Gly Arg Arg Trp Glu Pro Val Val Asp Thr Gly Lys Pro Ala Pro Tyr
705 710 715 720

Asp Phe Leu Thr Asp Asp Leu Pro Asp Arg Ala Leu Thr Ile His Gln
725 730 735

Phe Ser His Phe Leu Asn Ser Asn Leu Tyr Pro Met Leu Ser Tyr Ser
740 745 750

Ser Val Ile Leu Val Leu Arg Pro Asp Val
755 760

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<223> primer

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33